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b.p., in corresp. to final Dryas, a cold period, archaeologist discovered first villages of preceram. Neolithic with round huts and an econ. based on wild cereals, fruit foraging and large exploitation of sheep and goats which paleontology cannot define nor wild nor semidomest.; on the relationship of protoneolithic societies with the animals that were a staple of their food procurement only conjectures are possible, Hole, id. 340-41; a research made about affinities of cultiv. wheats' genoma and those of wild progenitors in different regions of F. Crescent, and today varieties of the same species, with the comparison of 288 loci of *T. boeoticum*, 204 of *T. dicoccoide*s, 400 of *Hordeum vulgare*, shows major similarities wheats of recent millennia with progenitors of Karcadag mounts, a chain separing the Tigris & Euphrates valleys, for barley a major genetical similarity with all posterior varieties is to be recognised in spontaneous ecotypes of Jordan, these risults appear to bear out hypotheses of unicity of domesticat. events for every species in the area amongst Mediterr., Caspian Sea & Iran Plateau, Salamini et al.id., 349-50

agriculture origins, Levant, cultivation. & animal tending would have been developed in a scenario of a broad spectrum economy, which in Mesolithic replaced big game hunting with fowl, rodents & molluscs, plus foraging of seeds & acorns, for the conservation of which settled caves show appropriate silos, at the end of Pleistocene prairies of wild cereals would have colonized Mesopotamic hillsides till Anatolian heighs, agriculture would not be born amongst spontaneous cereal fields, but where cereals must be planted by man, like in Khuzistan; broad spectrum economy, a rational system for exploiting a multiplicity of resources, protracts itself in first agrarian settlements, at Ali Kosh (Khūzestān, Iran) villagers utilize 5 food procurement: cereal cultivat., animal husb., hunting of quadrup., of birds, collecting of wild legumes, Flannery, VII, 237-39

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agriculture origins, India, lack of any paleobotanic & paleontologic analysis in excavations made by Indian archaeologists makes it impossible to trace reliable hypotheses. The only sure data from in Indus plain collected by Costantini at Merghar settlem, where in successive occupations between 8.000 & 4.000 b. C. villages staple are in succession semi-wild nacked barley, *T. monococcum, T. turgidum, T. durum,* then *T. sphaerococcum* e *T. compactum*; in 3d millennium B C tame spp. assortment is the same as in Indus Harappa civilisation, which in 2d millennium changes radically adopting summer spp. of Chinese origin, rice and *Setariae*, with a methamorphosis from **rabi** cultivation to *kharif* cultiv. (in Indian summer or winter crops), goats appear domesticated, sheep still wild, even diminishing their body dimensions, Costantini data, published in 1981, prove the use of irrigation, Meadow, VII, 343-345

agriculture, origins, India, non-existence, in 1973, of proofs of agricolt. before 4.000 b. p., when protocultivators arrived from Levant with cultiv. species typical of their birthplace, 1.000 y. later agric. started in China, Reed, VII, 272

agriculture, origins, Kara Kum (Turkmenistan), the desert which Vavilov gave different collocations in his successive geographies of Asia crops progenitors, Tell Jeitum revealed 3 occupation phases, starting, respectively, 5,500, 5,370, 5,050 b. C., economy

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agriculture origins, Mexico, at around 7.000 b.p. hunter-gatherers attended teosinte & setaria tufts, but metamorphosis of first plant was very slow and first agricult. settlements would presumably date at 3,500 b.p., exiguous number of domesticable plants & animals would have imposed a delay of 7,000 y. in comparison to F. Crescent, Reed, VII, 272-74

agriculture, origins, North China, in loess region, comprising Shensi, Shansi, Honan & Hopei, Neolith. culture of Yang-shao created from 5895 b. p. agricult. based on *Setaria* & *Panicum*, Ping-ti Ho 1977, VII, 251; about fertility Chinese loess, Pumpelly, id. 251; rice followed the 2 plants in late Neolith., wheat, barley and soybean would be imported in historical times, Ping-ti Ho, id. 252, from his birth Chinese agric. was completely extraneous from animal husbandry, in Yang-shao stations only traces of a presence of pig, horse, bovids, id. 253, starting water control for irrigation supposed at 100 a. D., id, 253; absolute absence, till 1973, of any reliable hyopothesis about origin of rice-based agric. for lack of archaeologic inquiry at the south of Yangtze, the area rationally candidate to be recognised as rice birthplace, Reed, id., 272

agriculture, origins, Palestine, between 19,000 & 18,000 b. p. Kebaran hunter-gatherers occupy hilly Mediterr. coast, 14,500-12,500 b. p. average rain increases multiplying resources, exploitable areas enlarge and new groups settle coming from Nile delta, social organization rests on little groups, new change in climate, with a decrease of rain, reduces again exploitable areas, and settelm. are concentrated near the coast, at the end Pleistoc. late Natufian culture establishes large villages thanks to ample dilation of wild cereals fields until a new aridity period, from 10,500 to 10,000 b. p. imposes to the same villangers the cultiv. of barley and legumes, Bar-Yosef, Kislev, 1986, VII, 323-24, this hypothesis connects apparently contradictory facts of climatic change & demographic growth basing agricolt. birth on cultivation of barley notwithstandig proved diffusion *T. dicoccoides* in the region, id, 324

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agronomy, *rotation,* Rothamsted 1893, wheat, last cycle's crop, sums up effects of other spp., Gilbert, VI, 117, highest yeld after turnip grazing & clover, id., 117, 125, without fertilisation fallow predisposes the field better than clover, which absorbs the disposable nutrients, id., 117, dressing only perphosphate the choice between fallow & clover is meaningless, id., 117, after the years favourable to clover wheat yelds touch the top, id., 118, grain & dry matter produce higher than in monosuccession, id., 121; higher dry matter production completely due to straw, id., 121; influence on Rothamsted yelds by 19th century wheat height, id., 122 entity P removed with sold products imposes reintegration, Gilbert, id. 125,

agronomy, *rotation,* Rothamsted 1893, after turnips without any dressing barley gives satisfactory yelds for good tillage without turips luxuriance, Gilbert, VI, 115, in dressed plots. max prod. in combination with fallow & grazed rapes, id., 15, N intake depends on turnips utilization: higher after grazing, reduced after pulling out for the stable, id., 115, yelds in any case lower than in monosuccess., with max. fertiliz. turnips luxuriance exhausts N & P, id., 121, 125

agronomy, *rotation,* Rothamsted 1893, clover insuccessful in many cicles was replaced by beans, tiny yeld but in any case N enrichment of soil, Gilbert, VI, 116, better production in plots receiving perphosphate, id., 116, on next crop opposite effects with or without fertilisation: in the former case clover improves soil conditions, in the latter accentuate the nutient lack, id, 117

agronomy, *rotation,* Rothamsted 1893, N intake, monosuccession & rotation comparison proves that wheat's is higher in rotation for any different factors combination, whilst barley after turnips suffers from turnips fertilised and brought to stable, which reduce intake under that of no-fertilised cultivation, but benefits from rape grazing on the field, Gilbert, VI, 122-23

agronomy, *rotation,* Rothamsted 1893, wheat, last cycle's crop, sums up effects other spp., Gilbert, VI, 117, highest yeld after turnip grazing & clover, id., 117, 125, without fertilisation fallow predisposes the field better than clover, which absorbs the disposable nutrients, id., 117, dressing only perphosphate the choice between fallow & clover is meaningless, id., 117, after the years favourable to clover wheat yelds touch the top, id., 118, grain & dry matter produce higher than in monosuccess., id., 121; higher dry matter production due to straw, id., 121; influence on Rothamsted yelds by 19th cent. wheat height, id., 122 entity P removed with sold products imposes reintegration, Gilbert, id. 125,

agronomy, *rotation,* Chicago 1893, the core of Agrarian Revolution, in the frame of Columbian celebrations, IV, 91, the ideal conclusion of the cycle opened by Weston, id., 91; experimental plan illustration, Gilbert, id. 91; the new relationship between arable & animal farming, , id., 92-112

agronomy, *rotation,* the summary of Agrarian Revolution, 1893 Chicago, in the frame of Columbian celebrations, IV, 91, the ideal conclusion of the cycle opened by Weston, id., 91; experimtal plan illustration, Gilbert, id. 91; the rotation from Thaer's theory

cil decided to study these formulas looking for truly innovative practices and ignoring any psychologic motivations, the inquiry verified how many solutions adopted by critics of traditional agricult. were truly rational and cost effective, the Council trayed to forsee in which misure these practices could contribute to the agriculture of the future, the average of the farms studied revealed to be innovative, from the philosophy the farmer claims, they frequently reduced the need of industrial inputs, which, with yelds something higher than the average ensured a good profitability, VII, 407-08

agronomy, eteronomous schools and doctrines for a "*new agriculture*", in contraposition to agriculture science founded on chemistry and biology, first mouvements start last 60' of 20th. century on the wave of reaction to deleterious effrects of insecticides and aticryptogamic compounds, VII, 383-85, proselytes gathered from milieus extraneous to agriculture, generally without any knowledge about, claiming the will to practise a "*biological*" (continental Europe) or "*organic*" (English speaking countries) agriculture; they profess a keen dislike for any chemical compound (fertilisers, parasite-killers) and new powerful machines, in the following years including seed produced by the new genetics, expecially by gene transposition, id. 384-85, in search of philosophical guidelines, to justify refusal of scientifical agronomy, the leaders claim the absolute perfection of the practices sealed by tradition, or engage themselves in obscure lucubrations they pretend to be real "scientific" demonstrations, id. 385, amongst the *gurus* the Japanese Fukuoka, who possessed an authentic experimental competence, proposed, in 1975, a doctine suggesting a radical reduction of human interference in natural processes claiming that, free to establish their equilibria, plants and animals would produce everithing necessary to human needs, his results appeared prodigious, but the disciples were everywhere incapable to repeat the successes of the master, id. 385-87; the Italian Garofalo, even with an agronomic experience, gathers a school under the standard of Draghetti, late director of Modena exprimental Station, author of a *Phyisiology of the farm*, printed in 1948; a clever experimenter, but unacquainted with history of agronomy, Draghetti treads in Thaer footsteps even ignoring the German's texts, in the simplest terms repeting a farm being a living organism, whose physiology consists in the perfect integration of the cycle of organic matter with that of mineral compounds, so developing a system of exchanges of nutrients between field crops and livestock, an idea whose application at the time of the publication already was a pure chimera, id., 387-88; in France Lemaire starts in the 60' a campaign against any new agricult. technoloy, his best follower, Saint Hénis, organises the teacher's claims in the manifesto of the opposition against the conversion, at time in tumultuous progression, of the traditional France agriculture into a modern economic sector, trying to demonstrate the horrifying dangers of the new productive means and boasting his lucubration as a true interpretation of Pasteur's pensée, which probably he never had read, id. 389-90; Aubert publishes in 1977 *L'agriculture biologique* picking up every imaginable proofs of the damages imposed by chemistry to human life and claiming the worst are inexplicable, a fact whose cause would be the impossibility to follow the translocation of the molecules produced by chemical synthesis, ubiquitarious and uncontrollable ghosts, capable of lethal effects at any unanalyzable dose, the unique way to prevent dangers being the interruption of any production, damages of same gravity would be produced by animals obtained by the modern selective breeding, id., 392-94; even an occultist, from the cultural milieu which precedes the nazi "science", the Croatian Rudolf Steiner, proposes himself as a master of a new agriculture philosophy, mixing in a colorful hocus-pocus confused reminiscences of alchemy, astrology and banal sorciery, he conceives the formulae to convert animal putrefied organs, full of rotten flowers or bark, in true "*condensers*" of stars powers, to be inoculated in the soil giving it the potential of astronomical yelds id, 395-96; amongst his disciples a passionate amateur of pedology, Pfeiffer, composes a blend of occultism and soil science which finally follows in the steps of Thaer, so emphasising the effectivness of the "new" 18th century agronomy, id. 398; ostentatiously claiming he will secure the neophits of organic agriculture the bases of a new science capable to defeat that of Galileo and Bacon, Altieri holsts the flag of

Agroecology, of which he would be the prophet, presuming to prove the insubstantiality of all the agronomical knowledge of the past centuries, ignoring the texts of hundreds of agronomists whose he never heard the names, claims the new science would verify any geographical, social, economic implication of any cultivation procedure, incapable to suppose that this was exactly what great agronomist were engaged to do for three millennia, always connecting agriculture's practice to the economic and social conditions of their time, id, 399; ensure his contribution to the exciting illusion an epistemologist, Norgaard, & an agriculture's historian, madam Hecht, the former reducing to a mechanical game the origins of experimental science, whose appears to ignore the fathers, the latter racounting the history of European agriculture as the history of the monosuccession, professing a false idea shared by number of American farmers, who never practised any kind of rotation, but Madam is presented to readers as an historian of world's agriculture, whose she proves to know only the consociations between herbaceous and arboreal species typical of primitive tropical agricultures, which she conceives as the only rational and productive way to obtain the fruits of the earth, id, 401-2; teorethical engagement of pioneers of "new" agricoltures collapses at the end of the century' when adepts concentrate their passion on the preeminent problem to obtain more and more conspicuous public subsidies, disregarding any doctrinal concern, as for the leaders, they continued their campaign against "*chemical agriculture*", the surest way to improve the business, and the continuous research of expedients allowing the yelds of associated farms to approach those obtained by traditional practices, id., 405; but obtaining, without chemistry's means, production comparable to those of "chemical agriculture" proposes objective difficulties: if the difference would be too large, all the devotees would be induced to the fraudolent use of chemicals, with the risk that the lucrative castle would be mined and collapsed, the only way to exorcise the danger being to give the adepts simple and effective means allowing for productions which, adding the public subsidies, could make the farm budgets sure and wealthy, id. 406

agronomy, water scarcity, possibility to increase soil reserves shaping it in bulks, or applying fallow, choosing precocius varietis of crops, forestalling the sowing, using expedients to prevent plants to expand superficial roots, Russell, VII, 227-28

agronomy, new millennium, necessity to increase global agrarian production, a need imposing an enormous engagement in research, supported by the will of nation community, the science disposes of means to win the challange, but political support is insufficient, as in 2000 claimed T. Reeves, general CIMMYT Director, VII 460-478; agrarian development is impossible in the world's poor regions without the progress of public health, culture, transport system, that is civilisation, N. Borlaug, id., 479; Asti report 2011 certifies after 2000 a increase in agrarian research financing by international community, rising its agromic bill from 26,1 31,7 billion $, China gained the first pace in global spendig, reaching the 13% of total investments, wilst India riduced its bill & agriculturel progress slackened, id. 479-480

arable crops, proposal of a classification, De Gasparin, IV, 176-77, connected analysis of cultural procedures, id., 175

arable crops, *cereals,* preservability foundation of historical role, I, 10-11, 14; taming centres, first hypotheses, China, southwest Egypt, intertropical America, De Candolle, VI, 7; the role in civilisation history, Reed,VII, 269; first cultivation geography, Helbaeck, Renfrew, VII, 243; prairy burning for hunting would have diffused cereals in Egypt, Harris, id., 262; proofs of cereals utilization in Paleolith. Egypt 15.000 b. p by sickle flints & a flat & a round grinding stones, Reed, id., 266, cereals would have passed Suez isthmus 13.000 b. p. & would have diffuse in Palestine, where Natufian hunter-gatherers would have adopted sickle & grinding stones, id. 266, cereal plenty would have induced Natufians to make them their staple, completly changing life-standards, to preserve grain building huts on a silo, so creating a village, id., 266, cereal-based agricult. would not be born in spontaneous grain fields, but in areas where gathereres would be driven by demographic pressure, where spontaneous grains did not grow, and to produce them it

identified by Vavilov, VII, 44-45, 374; wheat, resistence mechanism against Puccinia, id. 45, typical Mendelian process: pathogen get over defences of varieties lacking of mechanism against the specific attack, Salamini, id., 373; advantages of resistence based on a plurality of genes, application poligenic resistence against *Puccinia,* id., 374, proves aleatoriety of defence based on only one gene succession rices created by Irri to resist *Nilaparvata lugens*, a parasite unknown to entomology in years '50, which became the first enemy of the crop, attacking all the cultivars with a monogenic resistence, unable to resist more than 3-5 seasons, Conway, id., 375, possibility to oppose new resistant strains depends on presence of unknown resistance genes in germoplasm collections, id., 375; for the virus-resistance proved effective the insertion in the plant genome of the gene for the synthesis of virus capsule protein, penetrated in a cell, the virus cannot get rid of its envelope, then to reproduce, a procedure applied with success against rice, potato, lucerne viruses, id, 376, equally functional insertion of RNA "shears," id., 376

genetics, genetically modified plants, 2006 decennial commercial diffusion first g. m. maize, cotton, oil-rape, soybeen & rice, first 4 created by seed companies, rice by Chinese breeding, first 4 did bear only 2 lab-introduced genes, proving time entity necessary for creating a new g. m. cultivar; notwithstanding time and costs advantages are confirmed by farmers rapid adoption all over the world VII, 474-75; Phillips demostrates that g.m. varieties have risen rate of annual yeld improvement in Corn Belt from 2,8% in years '90 to 3,5% in successive decade; cost entity of every project explains why goals multiplicity in a number of countries for a plurality of species did not produce, at 2006, one only cultivar ready to diffusion, id., 476; Maggiore & Salamini outlined that varieties g. m. are expressions of a environmental revolution, because introduction of resistence genes allows a drastic reduction of biocide treatements, a proof of falsehood of claims of self professing environment tutors who fight genetics propagating in public opinion awful but groundless fears, id., 477-78

genetics, prospects for the new millennium, successes last 50 years obtained by rising harvest index, the fraction of organic matter reapened as caryopses, decreasing straw weight, wheat from 50 to 450 g/mq, in U.S. maize yeld increased 0.92 kg/ha/yr from 50 years, Salamini, VII 467-68; theoretically one could even rise wheat yeld enlarging spike dimensions or creating plants able to grow in major thikness, Skovmand, id., 468; with wheat hybrids, an endeavour attempted when today tools were not at disposal, a success would rise production of 20%, Grimanelli, id., 469; actual crops yeld often do not correspond to their potential because of field unfavoureable conditions, which may be faced introducing idoneous genes from wild parents, id. 469; Conway illustrates 3 rices projected at Irri for different conditions: for poor soils a perennial plant preadapted to symbiosis for autonomously providing N, id., 470; emblematic Adams project for a "new" bean: identified traits that do increase yeld, corresponding genes were found in germoplasm collections & composed in plants built accomplishing the design, id., 470; denying statement of maize continuous progress Mann underlines that in U S max. yeld in national competitions, with inputs at best level, dry matter product. is stable from 30 yr at 20 t., he is also sceptical about possibility to adjust physiology to increase dry matter synthesis, a purpose which would impose the "restyling"of dozens of genes, id., 471; first endeavours to create "new" plants would have produced frustrating results, cultivated plants would probably be close to biologic limits, id. 471; cereal jearly yeld increase did swing from annual 2,5% in years '70, then reducing to regain a 2% in the new millennium, when global produce was inadequate to contain the 2007 price blaze, id., 472; limit carbohydrates production depends on slowness enzyme RuBisCo, charged to capture CO_2, & high water quantity necessary to produce 1 kg organic matter, Mann cites projects to modify key process enzymes recongnizing that their performance depends on dozens of subservient enzymes, id., 473; Reeves relies on the possibility to reshape plant structure allowing for a new relationship with natural resources, id., 478; projects of Leibniz Institut show that results of future manipulation will be committed to improvement of mathematical modelling, id., 473

dictors: Fraas, Conrad, Rodbertus, IV, 41; Hehn, id., 42; rejection pedologic & climatic hypotheses about civilisation fall, Hehn, VI, 2, 27, substitution with racial lucubrations, id., 4, 27, VII, 125; Liebig's hypothesis confutation on the base of Hopkins calculation about supposed composition of "normal soil", Usher, VII, 127-29, claim of plant ability to take necessary elements from deep sterile layer, id., 128

natural resources, attribution of Roman empire fall to climate change, as would prove towns provided of aqueducts in regions today desert, Cyrene & Palmyra, evidence climatic change in Classical sources, the phenomenon would have triggered barbaric invasions, Huntington, VII, 124-25

natural resources, humankind-soil symbiosis lucubration: first cultivators established a symbiosis with earth fertile layer, seat of microbic life, which soil itself is unable to renew so becoming a duty of man, who neglecting it will condemn to death its symbiont, together condemning himself, Haussmann, VII, 131-33, following on Kautsky's footsteps he claims the necessity of a planet communist government, which entrusted of world's soils responsability agronomists free of any capitalistic constraint, exorcising capitalistic damages to the planet, id., 132

natural resources, supposition of soil exhaustion because civil man evaded the duty to restore fertility, consisting in humus ratio, exploited land & abandoned it, when exhausted after 30-70 generations, Dale, Carter, VII, 134-35, history would present only three exception: the valleys of Nile, Tigris-Euphrates, Indus, id, 134-35, irrigation would subtract cultivated land to its gloomy destiny, id, 135, proofs of the law in Italy & Sicily, supposing imaginary Roman population density, after the decline they magnify Italian population of 16th cent., id., 136; arbitrariness of generations computation, id., 136

natural resources, second 20th century's half, an age without precedents in mankind's history, global population increased from 2,5 to 6 billion, cereal production from 630 to 2.000 million t., marine fishing output from 19 to 90 million t., food availability from 2.300 to 2.700 calories p.c., VII, 449; growh factors may be identified in: 1- arables dilatation, from 1.346 to 1,511 million ha; 2- irriguous land enlargement, from 110 to 260 million ha; 3- fertilizer employment increase, from 14 to 146 million t. in terms of nutritional elements; 4- crops defence with insecticides/anticryptogamic treatments; 5- genetics, id., 450-51; yeld increase by employing energy in powerful machines: Pimentel shows that in 1977 Mexican *campesino* produced 1.94 maize t/ha consuming 52.762 kcal, while US farmer on the other bank of Rio Grande produced 5.39 maize t/ha spending 8.666.910 kcal., the former obtaining 128,2 kcal for 1 employed, the latter 2,17, id. 452; energy consumption for high yeld depends on large use of N produced by Haber-Bosh process: the synthesis of 300 kg N requiring 592 oil l, their dressing 38, with a total emission of 1.914 CO_2 kg; Cavazza calculated that a maize field producing 19.4 dry matter t absorbs from atmosphere 30,8 CO_2 t, which will not remain fixed as would be if absorbed by a forest canopy, energy demand by Haber-Bosh process was reduced, from the origins to the ninenties, from 80 to 27 GJ for 1 NH_3 t synthetized, whilst new livestock management do not produce manure proper to be transformed into humus, so that CO_2/ humus balance sheet of modern animal farming results sistematically negative, id., 453-54

natural resources, the questions about possible exhaustion, comparison of trends of resource consumption & polluant production employing dynamics of systems developed for most advanced computers, Mit's accounts for Club of Rome 1972 & '73, the identification of exponential processes, the metaphor of an alga redoubling every day in a lake: occupied half the area, how many days would pass to complete the invasion? VII, 367-68

natural resources, confessions, in particular Catholic and Protestant, & ideologies, had revealed, in the 50 yr. of world agriculture metamorphosis, an absolute indifference for any ethical proposal to preserve resources for future generations, VI, 176; while international conferences on the subject showed complete inadequacy, as that convened in 1987 by World Commission for Environment and Developement

natural resources, new Millennium Africa shows off all the negative records about

resurces use: only 7% irrigated land against 39% southern Asia, shrinkage total cereal production, years '90 wheat -0,81, rice -0,56, with the World's lowest p.c. cereal production: 147 kg/yr, reduction of p.c. livestock produce,; 300 million habitants with daily revenue < 1 $, VII, 458-59; Dellere identifies three keys of African tragedy: reduction from 25 to 5-10 yr. of soil regeneration where the forest-fallow succession was established, erosion of immense arid surfaces, with an average loss of 7 soil t/yr, incontrollable population growth, so to foresee 1 billion increase before 2050, id., 459; that nothwithstanding possibility to improve food situation as proved by experience of rice production in Ruwenzori footsteps in rain season, where fertilization plan designed by H. Breman & realized by S. Kavira produced yeld increases from 1,5 to 7-8 t/ha, id, 463; Smil calculated that *Leguminosae* contribution to increase N soil content falled, during 20th cent. from 50 to 20%, energy cost to produce N fertilizers suggesting to verify potential tropical *Leguminosae*, abstractly conspicuous, id., 465

natural resources, secular competition between food & energy production, fodders & feeding stuffs for draught & war animals, its apparent overcoming at the tractor appearence, re-proposition after dissolution of balance between food & energy prices at the end 20th cent. & organic matter employment to produce energy, VII, 297-98, 457

natural resources, forcast of future balance of cereals product./consumpt.: optimistic claim by Alexandrotos editor of Fao report for 1996 World Food Summit, VII, 460, and Rosegrant in the 1999 outlook for Ifpri; in 2000 CIMMYT account Reeves stresses that food availability must redouble within 2030, a task possible only with a unanimous international will; Mc Calla underlines the constant antithesis between economists & geographers-climatologists-argonomists evaluations, the former supposing ample development spaces secured by low last decades prices, the latter measuring natural resources unceasing depletion, id., 460; analysis possible continuity of last decades development factors: naturalists oppose tropical forests continual felling, for water geologists & geographers confute World Bank claim of the possibility to extend existing irrigation surface with 137 million ha of newly served areas, underlining damages to continental environment equilibria produced to rivers & lakes depletion by past sixties-eighties achievements, id., 461; any proposal to increase global fertilizer use kindle opposition because past damages to water bearing strata, id., 462; any increase in antiparasite compound use must be considered with caution, id., 462; among growth factors of sixties-eighty the one with uncompromised potential appears to be genetics, even if previously constant yeld increase contracted in the nineties even finding a new momentum in the third millennium, id. 464; in 1950 every planet's citizen was entitled to 0,53 arable ha, in 1996 to only 0,21, a surface which will greatly shrink in 2030, when even the irrigation possibilities will decrease, Gardner, id., 495; Brown evaluates that 1990 China cereal p. c. surface will contract from 0,08 ha, one of the world minor figure, to 0,03 in 2030, with unforseeable effects for the entire planet, id., 495 guidelines for wheat selection for matching with future planet population, Vavilov, VII, 60-61, necessity cooperation scientist of all involved disciplines, id.,62

natural resources, third millennium, Fao cumputes 1 billion people suffering hunger, but other 300 million to live with a revenue < 1 US $ per day, & it is incomprehensible how can satisfay minimal nourishing requirements, 3 billions dispose of calories for mere subsistence, it cannot be sure to forsee for 2050 10 billion well nourished people, VII., 454-55; the second 20th centry half marked the end of wheat, maize, rice civilisations: today China is the first wheat producer, but new welfare kindle an unprecedented demand for fodder & feeding cereals to convert in animal products, a phenomenon starting even in in India, both countries' autorithies claim that they will produce feedstuffs necessary to change nation's diet, but the proclamation is clearly mere sloganeering, id. 456-57; feedstuffs import is more credible, but accurate calculations show that import from the two countries could correspont to total world's exports, compiling India & China import balance sheet one must consider the US sales reduction because of large maize conversion into fluel, id. 457; Malthus had calculated that a population free from food

soil components, *humus,* composition, formed by colloids with negative charges, which bind with metallic ions, separation from mineral compounds starts with solution in Na hydroxide, fraction which not dissolves is defined humin, in dissolved fraction a strong acid makes humic acids to precipitate, fulvic acids remaining in solution, addition etanohol to humic ac. produces separation of a new solute from the precipitate, leaving in solid fraction humic molecules of sferic or ellipsoidal shape, with molecular wheigh till 200.000, containing N, S, P, as well as proteins, polipeptides, nucleic acids, Russell, VII, 166, chemical shapes are not well defined, but they correspond to half the C available, the other half, whose form is destroyed by analysis, is presumed to be formed by polymerized aromatic rings, C/N relation is constant about between 8.5 & 12.8, higher in virgin lands & prairies in cold climates, ploughing induces total C decrease, id., 166-67

soil components, *humus,* exchange capacity, wealth of radicals explains capacity to exchange, measured in milliequivalents/100 g of humus, in fertile soils major than 200, in acidic ones inferior to 70, Russell, VII, 167; the binding with cations have different nature: of neutralisation, polar coordination with water, hydration of ions Fe & Al, chelation, ions are chelated by means of oxydril ions, id., 168, humus joins clays & hydroxides with chains rich of radicals from gums & polyphenols from cell membane of fungi & bacteria, id., 168

soil components, *humus,* Woburn, formation-dissolution cycle, persistence 25% carbon from manure dressed during 19 years, green manure 14%, Russell, VII, 165, org. matter in soil is converted into humus in the ordinary fractions, progressive stages of decomposition, which is fastened by succession of moistening & drying, is lower in pastures and virgin prairies, enhanced by ploughing, with the tendency to a stable entity, typical for each soil, dipending on input and dissolution ratios, in American soil average lifetime calculated 10-45 yrs, in a Rothamsted plot, in a sample from 22 cm layer extracted in 1881 present humus aged 1,400 yrs,. beween 45 & 67 cm 3,700 yrs, id., 169, Rothamsted Broadbalk field, plot excluded by organic fertiliz. between 1865 & 1966 C lost from 0.105% to 0.099% organic matter, the one manured every yr. increased it from 0.175 to 0.251, both results being obtained in first decades, with a following stabilization, id, 170; org. matter decomposition times, Nicolaisen, VII, 89

soil components, *humus,* effects of buried vegetable residues on fertility, Columella, I, 67; doubts about how improve fertility better than with triennal cycle; Mitterpacher, III, ; vegetable decay, Rozier, III, 94; humus role is dependent from other components of earth, Thaer, III, 195; formation from vegetation residues with an increase of N & O_2 loss, De Saussure, III, 166, sterility of humiferous soils if they do not release soluble elements, id., 167

soil components, *colloids,* saturation trials with phospates solution of soils of different origin, Kuron, Grüneberg VII, 89

soil components, sand, role on earth characters, sandy are the most arid soil, Al 'Awwâm, I, 169, the crust after heavy rains is particulary strong in sandy soils, Russell, VII, 192, sand hinders root development, id., 194

soil components, *water,* field capacity, quantity retained by a soil when ceased infiltration & percolation, for every soil it correspons to a characteristic suction value, for good soils between 50 & 350 mbar, Russell, VII, 185; it is placed between complete saturation and wilting point, at which igroscopic forces prevail on root suction, VII, 288; between the two points Veihmeyer postulates omogeneity absorption forces, Richards claims the need of an increasing effort, id., 288; water moves in the soil for gravity, pressure or suction gradient, speed is max. when all the pores are full, when the major are empty it decreases on the 4th power of the capillaries diameter, mouvement conditioned by pellicles continuity, vapour flux is higher as higher is the gradient, Russell, VII, 185, at the beginning of a rain flux is speedy, then it produces bubbles & clods alteration, which slow it, in good earth the advancing front is distinguishable during many days, advancement is promoted by temperature, id., 185; water covers clods with pellicles, whose behaviour is analysed as a capillarity phenomenon, measuring menisci suction

force, the cause of earth contraction, when it drays, diminishing water content, tension increases reducing free energy, measured as *pF*, id., 183, the higher the organic matter range the higher the *pF* for the same water content, id., 184, after irrigation water flow ceases, water is stable & suction rises till values of 50-350 mbar, in corrispondence *pF* characteristic of that soil, winter suction in England 50 mbar, in Africa 350, id, 185, after rain water evaporates from superior layer till a dry stratum formation, losses for diffusion are lesser, soil stores more water from a long rain tham from many little successive, wind spurs evaporation, saline soils lose water for osmotic tension, id, 186, curves of relation between humidity (in %) & water tension, different during damping and drying, phenomena producing different series of tensions drawing sigmoid curves separed by a space defined hysteresis, Russell, id,183

soil chemical components, nitrogen, cycle, content analysis, De Gasaprin, IV, 191-94; supposition fertile earth to fix N from atmosphere id., 241; Ridolfi, IV, 275; role, Macagno, V, 217; N endowment undergo a succession of four oxidizations converting organic N into ammonia, Russell, VII, 170 ammonia into nitrate, nitrate into nitrite id, 170; in the soil always present ammonic & nitric N, the former absorbed by clays, is converted into the letter & washed out if not rapidly used by vegetables, analysis finds an higher quantity of N in fallow, probably vegetation inhibit nitrification, in pastures high ammonia degree, but low the nitrates one, for the scarcity of nitrification bacteria, id., 171; land loses N for denitrificat., conversion nitrates in nitrous oxide & gaseous N, the phenomenon takes place in fertile soils when aeration becomes scarce, in acidic soils for a chemical process, id., 172, Rothamsted plot abandoned in 1882 to meadow & shrubs, the latter being cleared some years later, showed in 1904 an N increase of 34 and 33 kg/ha/yr respectively in the two section, without any dressing, for rain contribution & microorganisms fixation, id., 173, difficulties to measure organic N fraction readily convertible in nitrates, but crops show it clearly, tillage produces soil moistening & drying spurring conversion in inorganic forms, fallow produces till 160 kg N/ha, &, if rains do not wash it, wheat absorb it completely, id., 204-05

soil chemical components, nitogen, failure of first pot-test, Home, II, 115-116; its unimportance, Liebig, IV, 25; pre-eminence among fertility factors, Lawes, Gilbert, opposition to the statement, Liebig, IV, 99-110; to increase the soil N reserves in the biennial cultivation, De Gasparin, IV, 301; N essential for wheat carbohydrates synthesis, Gilbert, VI, 142

soil chemical components, phosphorus, phosphates are present in soil as mineral ions and in organic forms (for example, inositols, essential for vegetal growth in phosphate-poor soils, phosphates include the series of mono, di, tri, and octacalcium phosphate – as well as the apatites, particularly hydroxy-apatite, which precipitates from the solution very slowly in crystals of uncertain composition due to the different nature of the external layer and the inner part, consisting in calcite crystals, this carbonate layer slows down the rate at which apatite christals in a solution of calcium, phosphate and carbonate ions reach equilibrium, the reason for the continuously changing relations between the different forms of phosphates, Russell, VII, 197, the solubility of phosphates is strictly correlated with that of iron and aluminium, P in solution in contact with soil is adsorbed following a curve from max. to min., a solution of a lower degree deadsorbs it tracing a different curve, which proves that a part of P has been fixed with stable bounds, id., 199, P in solution corresponds to $10^{-8}/10^{-4}$ M, a crop may take out 10-20 kg/ha proving that solution is continually renewed, id., 199, many trials were made to establish how much P to dress for creating the avalaibility for the max. production, a purpose infeasible because of differencies in soils, climate, cultivation variables, id., 199, particularly poor are terrains of tropics, where intake ability of coltures is generally high, id., 200

soil chemical components potassium, yeld increase from addition on wheat cultivated in pots, Home, II, 115; for regular intake needed concentration in soluton 5x10-5 M, exigent spp. require higher concentr., release to soil solution depends on position in

elements, Rothamsted, Gilbert, VI, 125-26, 129-30, cereals absorb less than forage-crops, but such an entity is completely exported by farm, & must be integrated by fertilizers, id., 131

soil chemical properties, exchange capacity, a concept abandoned after the understandig of the role of cation position in the clods, was measured determining the Ca quantity retained washing the sample in buffered solution, it presupposed fertile soil should be neutral, ignoring the Al role, which influences the behavior of all other ions, Russell, id., 148

soil chemical properties, pH, property of uncertain meaning, as clays are enveloped by two water strata, Stern & Gouy, adding an electrolite it compresses Gouy stratum & H ions activity increases lowering pH in Gouy stratum, so approaching the conditions of protons in Gouy stratum to those of the whole solution, Russell, VII, 148, pH varies with meteo conditions: rain produce cation delivery raising it, roots give out CO_2, which pull it down helping to forward P absorption, impossible at high pH, id, 149, among fertile soils one recognizes examples from pH 4,5 to 8,5, the former value corresponding to Al hydroxides dissociation point from clays, the latter to Na carbonate presence in soil solution, id, 149

soil chemical properties, organic matter decomposition, dead plants are firstly attaked by fungi which consume cell content, then by hemicellulose consumers, finally by those of lignin, at higher temperature bacteria keep part to process, lacking O_2 microorganisms produce methane, burying Italian ryegrass marked with C 14, 2/3 desappear in 6 months, 2nd fraction = 14% in 3 yrs., 6 months, 3dt follows ordinary dissolution time of 25 yrs., Russell, VII, 165

soil chemical properties, first researches, Boussingault, IV, 55; dimension of soil particles base of physical properties, De Gasparin, IV, 195, following on the steps of Ott & Schübler, id., 196, his analisys of soil physics defines 12 propertis & explains the measuring procedures, specific weight and density, tenacity, cohesion, hygroscopicity, water retention, speed of drying, shrinkage ratio through drying, permeability to oxygen, heat conductivity, aptitude to heat up upon exposure to sunlight, id, 197-99, 201-03, the measure of cohesion, or adhevisness, is important for assessing energy required for woking moist earth, id., 199, need to develop inquiry, id., 204; the list among the premises of Dokučaev work, VI, 65

soil physical properties, hygrospicity, hability for water retention, the value higher for organic loam, procedure to measure, De Gasparin, IV, 200, who defines water retention as *fraîcheur*, stating it to be the best proof of fertility, IV, 200

soil physical properties, texture is the ratio of composition of sand, silt & clay, measured by granulometrical analysis by flotation, De Gasparin, IV, 163; methods proposed after 1861, Cossa, V, 216; application Stokes equation to classify 4 particle classes, Atterberg, Russell, VII, 142, diagram U S Soil Survey to classify the texture of every soil , id., 143, sand and silt maintain peculiarities of original mineral, id., 143

soil physical properties, structure, ground fragment itself into clods of a certain stability, more stable in virgin soils, optimum pores 30-60 micron, with suction 50-100 mbar, glomerule shape is an essential element to classify soils, methods to assess stability, one can stabilize glomerules with Ca carbonate, special humus fractions, in particular polisaccarides, Al idroxides, Russell, VII, 191-92, addition org. matt. enhance fungi activity, followed by dissolution iphae by bacteria, which promote structure, favourable contribution by earth-worms and some crops, like lucerne, conversion into pasture increases glomeules solidity & decreases apparent specific wheight, id., 192, grazing destination improves stability, but in rainy days animal hooves damage it, id., 193

soil physical properties, temperature, colour role, Al ʻAwwâm, I, 168; De Gasparin, IV, 202-03, time for heat absorption, assessing procedure, De Gasparin, id, 203, time heat loss, masuring procedure, id., 202; colour affects temp., a dark one absorbs radiation & speeds up germination, a clear one delays it, in warm regions irrigat. cools earth, crop

coverage shuts out solar radiation directing a part to soil, which gives back a fraction to vegetation, in cool soil roots grawth is slow, at middle latitudes crop roots need 20° C, in tropical regions 30°, Russell, VII, 178-79

soil physical properties, relation with atmosphere, air composition in the earth varies dependening on earth nature & soil moistness, in clayey soils air mouvement are slow, O_2 permeate a moist soil slowly for the low air solubility, in deep strata one arrives to a point where there is no O_2, manuring increases CO_2, but also porousness, & air composition is similar to that in unmanured soil, microorganisms utileze O_2 with efficient cytochrome oxidases, but they are screened by the membranes, which slow intake, Russell, VII, 181-82

soil physical properties, O_2 absorption, specific every soil's aptitude, measuring procedure, De Gasparin, IV, 201; soil absorbs O_2, which roots & microorg. consume, the relation between O_2 absorbed & CO_2 produced is defined "respiratory quotient", a luxuriant culture may absorb, during the growth season, 17,5 O_2 t/ha, rain inflow brings O_2 saturate water, which diffuses from higher concentr. layers to lower's ones, flux is proportional to free porous entity, Russell, VII, 180-81

soil physical properties, length solar waves which reach soil 100 μ, refracted between 3 & 100 μ, at Rothamsted energy absorbed 0,15 kjoule cm^2/day in Dec., 1,76 in June, in July soil temp. can vary 20° C in the day, at 30 cm deepness max reached in July, at 3 m deepness in Sept., annual excursion at 3 m 5,5° C, of the received energy albedo is given back, a part heats soil, one evaporate water, Russell, VII, 178

soil complex properties, fitness to agrarian exploitation, 7 US Soil Survey classes of decreasing suitabiliy, depending on 5 obstacles hindering vegetation, due to hydrology, soil morphology, its nature, subjection to erosion, climatology, Russell, VII, 221-22

soil complex properties, fertility, La Quintiye, II, 38; Evelyn, II, 52-53; Carradori, III, 150; the only absortpion from soil are soluble elements, De Saussure, III, 174, 177; definition of conventional yardsticks to the measure of fertility consumption & addition of every crop, Thaer, III, 192-93; alternative criteria proposed by successors, III, 193; Liebig, IV, 27; relative character in relation to the "exhausted state" at the end of a rotation, Lawes, Gilbert, IV, 97; De Gasaprin, IV, 165-66, 206;; ability to exchange cations & anions, Russell, VII, 145, Israel 1978, the giving up of the role of soil fertility and its substitution with the needed amount of fertilizers with water to the single plant, Ravitz, VII, 288

soil complex properties, fertility assessment analysing the cenosis of wild vegetation, Al 'Awwâm, I, 169; weeds able to confront specific anomalies, id., 170, vegetable showing soil nature, Liebig, IV, 27

soil complex properties, fertility exhaustion by protracted cultivation, Virgil, I, 51, Columella, I, 59, 65, 67; Liebig, IV, 28; restoration fertility elements prevents soil depletion, Columella, I, 88; Liebig, IV, 29-30, need to restore P for all & every vegetable, id., 30; Boussingault, IV, 53-54, 62-63, 65-66; De Gasaprin, IV, 206; Gilbert, VI, 133-34

soil analysis, empirical tests to assess its qualities, Columella, I, 70, Al 'Awwâm, id., 160; Geoponica, id., 149

soil chemical analysis, Home discovers the Ca presence II, 113; the constituents, Thaer distinguish *silica, alumina, lime* & *magnesia*, III, 194; Davy adds many salts to previous lists, III, 286; Boussingault proclaims P preeminence, IV, 54, analysis procedure, id., 56; De Gasaprin, IV, 191, whole soil, procedure, id., 192-93, nitrogen analysis, id., 194-95

soil genesis, role of atmospheric agents in rocks breaking up, Al 'Awwâm, I, 168, sterility primary soils, id., 168; first list primary rocks, catalogue elements delivered by disgregation, Davy, III, 286; Boussingault, IV, 28; De Gasparin, id., 164, 189; Davy's intuition foundation 19th cent. pedological research, VI, 58; the climatic genesis theorem, Dokučaev, VI, 72-73; new information about soil genesis, Passerini, VII, 68; soil amalgam of rocks debris & remains dead vegeal & animal creatures, key factor of breaking up

different forms, id., 153, difficulty to classify actinobacteria, generally aerobic & eterotrophs, id., 153

soil microbiology, fungi living in the soil: *Myxomycetes, Phycomycetes, Ascomycetes, Basidiomycetes*, comprising saprophyte & parasite, in ordinary soil are present 1 million spores/g, saprophyte are highly efficient in converting organic matter into protoplasm, acidity tolerant, show different speed in polysaccharids & lignin consump., Russell, VII, 154, fungi send forth mycorrhizae which penetrate into roots with hyphae fom which minor hyphae settle in the cells giving rise to organelles in the form of bushes or tufts, mycorrhizae develop with good aeration, organic matter availability, mineral elements' lack, which induces plants to symbiosis, exchanging organic substance in excess with the insufficient N, id. 163; in Sweden forests the cession may reach 0.389 t/ha of ternary compounds converted into umbelliform mushrooms, Romell, VII, 164

soil microbiology, N fixation in submerged environment, in paddies fixation is performed by algae & heterotrophic bacteria, which in Asia provide N for a normal yeld, N excessive dressing may activate denitrification, which can be avoided by slow-dissolving fertilizers, Russell, VII, 215

soil microbiology, protozoa: rhizopods (mostly amoebae), flagellates, ciliates, dimens. from 2 to 40 micron, feeding on bacteria but stimulating bacterial metabolism, in unfavourable weather conditions they form cysts , Russell, VII, 155

soil microbiology, 1895 research of N fixing bact.in different regions' terrain, Winogradsky, VI, 81, discovery fixing ability of *Clostridium*, id., 83-84; 1889 discovery same property in *Azotobacter chroococcum & Granulobacter*, Beijerinck, VI, 86, fixing favoured by symbiosis, id., 86; classification in 4 groups: *Azotobacter chroococcum, Beijerinckja, Clostridium, Klebsiella, Achromobacter*, the former being the most active, demanding a O_2 moderate concentration, the process seems to be the same for all, requiring Fe, Mo, Co & B, N is bound to α-chetoglucaric acid, Russell, VII, 173-74

soil microbiology, N fixation in symbisis with *Papilionaceae, Rhizobia* are of short-rod form, becoming T or Y shaped when the conditions are unfavourable, many classifications suggested, but relationships between bact. & plants are not constant, they are attracted by roots' exudates, in particuar by tryptophan, enter into roots trough a filament & settle into membranes produced by roots, where they convert into bacteroids loosing some properties, when active they assume a pinky colour, as nodule ages they come back to bacterial state concentrating on cell walls, and after the root's death they spread into the soil, the process is governed by specific plant's genes, the number of free cells varies in different soils, Russell, VII, 175

soil microbiology, root-bacteria symbiosis, apical root segment is surrounded by bacteria & fungi, in poor earth competition arises for essential elemens, in rich soils exchanges are continuous, in developed segments patogen saprophytes manifest their properties only if root faces adverse conditions, *Azotobacter* inoculum stimulates a favourable flora for wheat, Russell, VII, 163

soil microbiology, soil microorganisms include bacteria, actinobacteria, algae, protozoa, autotroph & eterotroph, not a rigid separation, the latter require compounds they are not able to synthetize, Russell, VII, 152, they all absorb from the soil P, K, Na, Ca, Fe, S, traces of Mn, Zn Cu, Co, B, id., 152, the O_2 source distinguish aerobic & anaerobic, id., 152, quantity of catabolytes is lesser the higher O_2 availability,, id., 152

soil microbiology, sulphur bacteria, utilize sulphates as O_2 source., Winogradsky, VI, 80

soil microbiology, biocide compounds degradation, microorg. acquire ability to decompose toxic compounds & consume molecules of the same crystallographic conformation, some biocides, as organic chlorides, are slower to be demolished, Russell, VII 161, the catabolites being the key of symbiosis & antagonism among bacterial strains id., 161, many actinomycetes produce antibiotics, but the effect in the soil is exiguous, some fungi in favourable conditions may stop other's proliferation, sterilization interfers on relationship between microorganisms & toxic compounds, id. 162

soil zoology, fauna traditionally divided into meso and macro-fauna, the former comprising rotifers, nematodes & artropodes (which include acarids, collembola & other insects) the latter including earhworms, millepedes, centipedes, chilopoda, insect larvae, ants & termites, Russell, VII, 156-58, macro-fauna accomplish a capital role for the earth stirring id., 156; fertile forest soil may contain till 2.000 earthworms kg/ha, the same wheight of cattle on the same surface, Bornebusch, VII, 156, consumed oxigen corresponds to demolished org. matter, difficulty to classify earthworms, whose presence is different in manured & no-manured fields, they phagocite dead org. matter but their metabolism was not yet known, in rainy conditions they trasport to the surface till 25 t/ha/yr of earth, Russell, VII, 157,; equally important the division between phytophage & soprophage creatures, id. 156; digging their galleries earthworms, ants & termites perform a capital function mixing & remixing soil particles, id. 157, 158

soil zoology, ants, ubiquitarious on the continents, termites only in equatorial regions, they build up earth heaps of diameter till 18 m, 7.5 m hight., where collect org. matter on which mushrooms, being their food, develop, abandoned termitaries are occupied by different species, *Diplopoda* & *Isopoda* are organic matter consumer, Miriapoda are predator, presence *Gasteropoda* & *Rodents*, Russell, VII, 159

soil zoology, a variety of saprofagous, phytofagous, coprofagous & predators cooperate in different ways to succesive stages of organic matter dissolution, consuming the same chewed food,

soil zoology, earth-worms contribution to mix up geologic & organic elements of amalgam, Darwin, VI, 58, study of mixing of correctives spread on the surface with subjacent terrain, id., 60, measure submersion in land of ancient monuments, id., 61

soil ecology, organic matter decomposition follows a regular succession, most dynamic organisms precede competitors, producing catabolites which favour different creatures, in the multiplicity of microhabitats even the less aggressive find their feed., Russell, VII, 159-60, soil life depends on organic matter produced by autortoph organism, plants & algae, whose energy is dissipated, catabolites are utilised from different creatures in succession, in Broadbalk plots energy consumption evaluated in 16 billion joule/ha/yr, id., 160, bacteria need a water film, for fungi steam is sufficient, temp. is essential, till to a max. which stops microbic activity, following the schema of perfusion experim. of Schloesing & Muentz one can verify successive consumers of originary substance catabolites, id., 160

soil nature alteration, erosion, phenomenon seriousness on planet scale, Passerini, VII, 68; diffusion in El Salvador because of slopes cultivation, Klinge, id., 93; entity in Armenia in all the fields on sloping terrain, Mirimanjan, id., 93-94; India, Pereira, id., 447; multiplicity inquiries proves progressive deterioration planet's soil inheritance, Wageningen 1992 report mentions 2 billion ha pasture, forest, arable damaged, on 22% land used to produce food withdroval of 25-75 billion soil ton, Rainelli, id., 482; from 1950 long dispute among geographers, climatologists, botanist & agronomists about overgrazing role in desert dilatation, a process which excites an old polemic, in 2006 Hein & Ridder dimostrate that after rain African desert do not react with the production of the fast & large mass of new vegetation as, with equal water quantity, in past, id., 483, Gruhn & others underline harmfullness of communal pasture, which induces herders to multiply head number so to appropriate of maximum of vegetation, ignoring the damage to the collective resource, id, 484

soil nature alteration, hydraulic erosion, it occurs when rain quantity exceeds infiltration capacity, the higher the water violence, the greater the volume of sediments brought away, among the causes cinetic energy drops, which destroy clods tamping pores, cloddishness protects soil state, an efficient defense consists in dividing land in stripes parallel to contour lines plantig in each a different crop, a rotational meadow loses 4,3% of rainy water against 40,3% of maize in monosuccession, rotation has positive effects, soil losses are in proportion to water stream on the surface, 0,05 t/ha in pastur-

soil mamagement, eolic erosion stoppage, damages prevention a controversial subject, but even more discordant opinions about stopping the phenomenon, experience of U S dust bowl, hurricane series started in 1934 after ploughing and cropping the arid soils of the windy region of Great Plains demonstrates that erosion can be controlled, but the amount of scientific & financial means employed can not be adopted in poor countries, VII, 484; Conway mentions projects for erosion control in Zimbabwe 1929-39 & Malawi 1945-60, abandoned by population which did not comprehend the goals, the same result for 200.000 km of terraces on Aethiopian plateau after 1978 hurricanes, id., 485; positive results in China & other countries where the peasant propensity to plant trees into arable fields was stimulated, id. 486

soil mamagement, salinity correction, the most effective procedure is to percolate water which washes away salts, it also helps to grow vegetables which absorb salts & to bring plants away at maturity, in Sudan *Atriplex muelleri* proved to absorb 0,5 t Na/ha/yr., if a irrigation system succeeds in draining soil washing away salts, the drainage water may deposit them in subjacent systems, where salts accumulate, Russell, VII, 224

soil, land reclamation, land submerged by sea invasion, which leaves NaCl, may be performed dressing Ca sulphate, which will be converted in Na sulphate, allowing rains to wash away Na, Russell, VII, 224

soil, land reclamation, France, Landes project, whose soils are sandy acidic with an humiferous subsoil & ferruginous concretions, combination of deep trenching & lime dressing, results analysis, Delmas, VII, 91

soil, land reclamation, Spain, project for large salt lagoon at the Guadalquivir mouth, alkaline clays, need of washing alkalis away, river water inaptitude because tide height, compelling to use rain water, even if scarce, Covián, VII, 90

soil, land reclamation, waterlogged areas, imposes slow elimination sulphides, wich are converted into sulphates lowering pH & interacting with Ca carbonate, the necessary washing of salts may be very slow, Russell, VII, 215

textile & dyeing spp., cotton, 1860, Manchester manufactures pretend their row material production be improved in Indian empire, facing government opposition to avoid land subtraction to opium production, Kumar, VII, 440

textile & dyeing spp., cotton, spreading in south Italy during U S civil war, Arduino, III, 321

textile & dyeing spp., flax, place in the rotation, Gallo, I, 298, cultivation practices, id., 299, times for uprooting & retting, id., 299, fiber extraction: braking & *spadolatura* (by a spatula), id., 299

textile & dyeing spp., flax, beginning 19th century, role in Cremona province's rotations, Bellò, III, 304

textile & dyeing spp., hemp, cultivation practices, Gallo, I, 299-300; Tanara, id., 466-471, tillage & fertiliser dressing, id., 467-70; Baruffaldi, II., 124, soil works, benefits of spade use, id., 124; beginning 19th cent., 3 plough works followed by spade *ravagliatura* (furrow deepening), Re, III, 414

textile & dyeing spp., hemp, cultivation, productivity, seeding thikness & stalks height factors for fibre quality, Gallo, I, 299-300

textile & dyeing spp., hemp, procedures for fiber separation from stalk, Gallo, I, 300; Tanara, I, 472; Baruffaldi, II, 125-26; integration scutch work with wood or stone rolls, Amoretti, III, 64

textile & dyeing spp., hemp, retting procedure, Tanara, I, 471-72; Baruffaldi, II, 127; retting effects on fiber quality, Tanara, I, 471-72; Baruffaldi, II, 127-28; substitution retting into water with earth heap, Amoretti, III, 64

textile & dyeing spp., key dyes role for 16th century textile industry, I, 301

textile & dyeing spp., 19th century Two Sicilies kingdom, cotton cultivation in Apulia & Sicily, Onorati, III, 141; 1959, program to employ genetics to create lines more suitable for regions where is traditionally cultivated, Barbieri, VII 81

211, tropic. plants better tolerate low pH, because in warm soils Al do not produce hydroxils which deliver Al ions, id., 211

vegetable physiology, water absorption/yeld entity, water volume to produce 1 g dry matter is in inverse proportion to soil whealth, in a poor soil more water is required to obtain the same yeld,proofs in jar, Rosanow, VII, 102; water rises to leaves outdoing ducts viscose resistence & cell's membrane reduced permeability, then evaporates from the stomata in measure dependent from the net solar energy received by leaves (excluded any other energy dispersed in the atmosphere, transformed in heat or converted into chemical energy, VII, 187, evaporation is the major component of the sommation of converted light energy, the measure was operated by comparison of a green canopy & a water surface taking into account temper., leaves roughness, the degree they are wet, id, 187-88, generally evapor. corresponds to 0,7- 0,8 of loss from water surface, from a luxuriant cultivat. is more than 1, with a suction of 5 mm/die, when water decreases, tugor force increases, stomata are shut, leaves warm up, time for wilthing depends on amplitude of root system, id., 189, tropical species absorb with a force of 15 bar till 4 m deepness, damage of interrupted transpiration is major in plentifully fertilized culivat. than in those poorly dressed, id., 189, disposable water corresponds to that placed between field capacity & wilthing point, Veihmeyer, id. 190 but the criterion is not valid for all agronomic situations, water lack in crucial phenologic phases (flowering) undoes the rentability of total water during the cultivat. cycle, losses may be contained reducing supply in other cicle-phases id., 190, crops production is proportional to volume of transpired water, traspiration stop reduces production, Ravitz, id., 288

vegetable physiology, root exudates: stimulate or depress effects on parasites eggs or spores, effects on same species' or different species' plants, Russell, II, 197

vegetable physiology, selectivity radical absorption salts in solut., presence some ions in soils solut. is independent from humidity degree, some are present in an insuffic. measure, solut. around roots is rich in not absorbed elements, lacking in readily absorbed elements, Russell, VII, 196, root activiy demands O_2 pression within water beween 0,6 & 0,2 bar, if CO_2 prevails in soil air it stops metabolism because of toxicity products of bacterial reduction, id., 182

vegetable physiology,, nutrition, barley P & N absorption lower in adverse growing conditions, higher in plenty yelds, Gilbert, VI, 97, the evidence prooving the correlation between K presence & carbohydrates synthesis, id., 99, clear relation in beans, id., 127;

vegetable physiology, soil solution is in balance with exchange complexes & decomposing rocks, ions diffuse by water convection & diffusion in solution, roots absorb from solids & liquids, some reach roots in quantity major than needs, some in insuff. quantity, Russell, VII, 196, presence ions in roots corresponds to difference between absorption & transfer selectivities, absorbed P is partially kep by roots, ions compete for absorption, high K presence hinders that of Mg, among absorbed ions charge neutrality is preserved. id., 196, solution composition to nourish plants with microirrigation, Noi, VII, 291

vegetable physiology, root ability to extract K from clay exchenge sites, in jar proves, Boischot, Latuner, VII, 99-100; essential to neutralize cell juices, role in sugar photisyntetic formation, Russell, VII, 140; vegetable physiology, inquiry on effects of minimal & maximal temp. on vital functions, Bustarret, VII, 77

vegetable physiology, nutrition, Na conspicuous need, whose function remain unknown, S, protein element, Si, necessary for Gramineae vegetative organs, Cl, necess. to tobacco, Russell, VII, 140, necessity Co & Mo for N symbiotic fixation, conspicuous necessity B for peculiar species, in particular sugar-beet & fruit trees, id., 210, P role in nucleic acid phosphorilation, cellular division premise, Russell, VII, 140-41

vegetable physiology, photosynthesis, process key the enzym RuBisCo, judged "slow", utilizes a minimal light-energy fraction & between 250 & 700 water l. for every kg of synthetized carbohydrates, first proposals to improve efficiency in the '70, first research investment in 90', without any result, because the mutation of the key gene im-